NATIONAL GUIDELINE CLEARINGHOUSE™ (NGC) GUIDELINE SYNTHESIS

PREVENTION OF VENOUS THROMBOEMBOLISM (VTE) FOLLOWING TOTAL HIP AND KNEE REPLACEMENT

GUIDELINES BEING COMPARED

1. **American Academy of Orthopaedic Surgeons (AAOS)**. American Academy of Orthopaedic Surgeons clinical guideline on prevention of symptomatic pulmonary embolism in patients undergoing total hip or knee arthroplasty. Rosemont (IL): American Academy of Orthopaedic Surgeons (AAOS); 2007. 63 p. [49 references]
2. **American College of Chest Physicians (ACCP)**. Prevention of venous thromboembolism. American College of Chest Physicians evidence-based clinical practice guidelines (8th edition). Chest 2008 Jun;133(6 Suppl):381S-453S. [728 references]
3. **Committee on Perioperative Evaluation (CAPO), Brazilian Society of Cardiology (BSC)**. Steps to reduce surgical risk. In: I guidelines for perioperative evaluation. Arq Bras Cardiol 2007;89(6):e197-208.

TABLE OF CONTENTS

AREAS OF AGREEMENT AND DIFFERENCE

A direct comparison of recommendations presented in the above guidelines for prevention of VTE (DVT or PE) following total hip or knee replacement surgery is provided below.

Areas of Agreement

Postoperative Screening

Neither AAOS nor ACCP recommend routine screening for DVT or PE in asymptomatic patients postoperatively. According to AAOS, there is neither a sufficiently sensitive noninvasive screening tool nor a clearly established period of risk for VTE as to make routine screening reliably predictive or cost-effective in preventing PE. ACCP recommends against the routine use of DUS screening before hospital discharge. BSC does not address postoperative screening.

Areas of Difference

Mechanical and Pharmacological Prophylaxis

While all groups cite warfarin as an acceptable therapy in all patient groups, recommendations regarding other medications differ. Both ACCP and BSC recommend a LMWH (BSC specifies enoxaparin). ACCP also recommends fondaparinux; BSC does not. BSC recommends heparin for THR; ACCP does not.

AAOS, in contrast to ACCP, stratifies patients into four categories based on VTE risk and risk of major bleeding: standard VTE/standard bleeding risk; elevated VTE/standard bleeding risk; standard VTE/elevated bleeding risk; and elevated VTE/elevated bleeding risk. Warfarin is recommended for all four patient groups. Aspirin is recommended for all groups with the exception of the elevated VTE/standard bleeding risk group. LMWH and synthetic pentasaccharides are recommended for the standard VTE/standard bleeding risk group and the elevated VTE/standard bleeding risk group. No chemoprophylaxis is also cited as an option for patients at elevated risk of major bleeding. BSC stratifies patients into four categories based only on VTE risk: low risk; moderate risk; high risk; and very high risk.

Recommendations regarding mechanical prophylaxis differ slightly. According to AAOS, unless contraindicated, mechanical compression should be utilized for both total hip and knee arthroplasty for all patients in the recovery room and during the hospital stay. They also cite sole use of mechanical prophylaxis (no chemoprophylaxis) as an acceptable option in the two patient groups at elevated risk of bleeding. BSC also recommends mechanical prophylaxis for all patients, specifically IPC or compression stockings following THR, and IPC following TKR.

For patients undergoing THR or TKR, ACCP recommends the optimal use of mechanical thromboprophylaxis with the VFP or IPC for patients with a high risk of bleeding. When the high bleeding risk decreases, ACCP recommends that pharmacologic thromboprophylaxis be substituted for or added to the mechanical thromboprophylaxis. ACCP also cites the optimal use of IPC as an alternative option to anticoagulant thromboprophylaxis in patients undergoing TKR.

Initiation of Thromboprophylaxis

Recommendations regarding when to initiate LMWH and fondaparinux differ. For patients receiving LMWH, ACCP and BSC recommend starting therapy either preoperatively or postoperatively (at a usual high-risk dose [BSC specifies 40 mg sq], started 12 hours before surgery or 12 to 24 hours after surgery, or 4 to 6 hours after surgery at half the usual high-risk dose and then increasing to the usual high-risk dose the following day). AAOS, in contrast, recommends that

administration of LMWH should begin 12 to 24 hours postoperatively (or after an indwelling epidural catheter has been removed).

With regard to fondaparinux, AAOS recommends initiation at 12 to 24 hours postoperatively (or after an indwelling catheter has been removed). ACCP, in contrast, recommends starting fondaparinux either 6 to 8 hours after surgery or the next day. BSC does not mention fondaparinux.

Duration of Thromboprophylaxis

For patients undergoing THR or TKR, ACCP recommends thromboprophylaxis with one of the recommended options (LMWH, fondaparinux [synthetic pentasaccharide], or a VKA) for at least 10 days and extending up to 35 days. AAOS, in contrast, recommends therapy with LMWH and synthetic pentasaccharides for 7 to 12 days, noting that the LMWHs and the synthetic pentasaccharides have not been sufficiently evaluated for longer periods to allow recommendation beyond this period. According to BSC, prophylaxis should last at least 7 days for THR and at least 7 to 10 days for TKR.

COMPARISON OF RECOMMENDATIONS	
GENERAL RECOMMENDATIONS **Abbreviations** **Back to TOC**	

AAOS (2007)	*The following recommendations are based on the results of the objective AAOS Consensus Process in which the work group members participated.*
	
	Pre-Operative Care
	
	• All patients should be assessed pre-operatively for elevated risk (greater than standard risk) of PE. The following patients are examples of those considered to be at elevated risk:
	  • Hypercoagulable states
	  • Previous documented pulmonary embolism
	
	(Level III, Grade B)
	
	Currently no specific laboratory test can reliably identify patients at elevated risk of PE. Therefore, careful history taking and physical examination in combination with clinical judgment, which integrates knowledge of specific risk factors with the patient's clinical status is the cornerstone of PE risk management for patients undergoing hip or knee replacement. The identification of patients at elevated risk for PE is important in the selection process of appropriate thromboprophylactic regimens.
	
	• All patients should be assessed pre-operatively for elevated risk (greater than standard risk) of major bleeding. Patients with the following conditions are examples of those considered to be at elevated risk:
	  • History of a bleeding disorder

- History of recent gastrointestinal bleed
- History of recent hemorrhagic stroke

(Level III, Grade C)

Note: Grade of Recommendation reduced because of lack of consistent evidence on risk stratification of patient populations.

- Patients with known contraindications to anticoagulation should be considered for vena cava filter replacement. **(Level V, Grade C)**

Intra-Operative Care

- Patients should be considered for intra-operative and/or immediate postoperative mechanical prophylaxis. **(Level III, Grade B)**
- In consultation with the anesthesiologist, patients should be considered for regional anesthesia. **(Level IV, Grade C)**

Post-Operative/Inpatient Care

- Postoperatively, patients should be considered for continued mechanical prophylaxis until discharge to home. **(Level IV, Grade C)**

  Unless contraindicated, mechanical compression should be utilized for both total hip and knee arthroplasty for patients in the recovery room and during the hospital stay. The optimal number of hours daily that mechanical compression should be used is unknown. A team approach involving surgeons, nurses, aides and therapists is required to optimize the amount of time the devices are on the patients' limbs. Many patients are transferred to "same site" rehabilitation floors or hospital services early postoperatively. It is recommended that mechanical prophylaxis continue at these locations if practical.

- Postoperatively, patients should be mobilized as soon as feasible to the full extent of medical safety and comfort. **(Level V, Grade C)**
- Routine screening for DVT or PE postoperatively in asymptomatic patients is not recommended. **(Level III, Grade B)**

Discharge to Home

- Patients should be encouraged to progressively increase mobility after discharge to home. **(Level V, Grade C)**
- Patients should be educated about the common symptoms of DVT and PE. **(Level V, Grade B)**

Note: The level of evidence is level V, expert opinion, but the strength of recommendation is B rather than C because patient education is consistent with the minimal expected standard of care for today's medical practices.

ACCP (2008)	**<u>General Recommendations</u>** **Hospital Thromboprophylaxis Policy** • For every general hospital, the guideline developers recommend that a formal, active strategy that addresses the prevention of VTE be developed **(Grade 1A)**. • The guideline developers recommend that the local thromboprophylaxis strategy be in the form of a written, institution-wide thromboprophylaxis policy **(Grade 1C)**. • The guideline developers recommend the use of strategies shown to increase thromboprophylaxis adherence, including the use of computer decision support systems **(Grade 1A)**, preprinted orders **(Grade 1B)**, and periodic audit and feedback **(Grade 1C)**. Passive methods such as distribution of educational materials or educational meetings are not recommended as sole strategies to increase adherence to thromboprophylaxis **(Grade 1B)**. **Mechanical Methods of Thromboprophylaxis** • The guideline developers recommend that mechanical methods of thromboprophylaxis be used primarily in patients at high risk of bleeding **(Grade 1A)**, or possibly as an adjunct to anticoagulant-based thromboprophylaxis **(Grade 2A)**. • For patients receiving mechanical methods of thromboprophylaxis, the guideline developers recommend that careful attention be directed toward ensuring the proper use of, and optimal adherence with, these methods **(Grade 1A)**. **Aspirin as Thromboprophylaxis** The guideline developers recommend against the use of aspirin alone as thromboprophylaxis against VTE for any patient group **(Grade 1A)**. **Anticoagulant Dosing** For each of the antithrombotic agents, the guideline developers recommend that clinicians follow manufacturer-suggested dosing guidelines **(Grade 1C)**. **Renal Impairment and Anticoagulant Dosing** The guideline developers recommend that renal function be considered when making decisions about the use and/or the dose of LMWH, fondaparinux, and other antithrombotic drugs that are cleared by the kidneys, particularly in elderly patients, patients with diabetes mellitus, and those at high risk for bleeding **(Grade 1A)**. Depending on the circumstances, the guideline developers recommend one of the following options in this situation: avoiding the use of an anticoagulant that bioaccumulates in the presence of renal impairment, using a lower dose of the agent, or monitoring the drug level or its

	anticoagulant effect **(Grade 1B)**. **Antithrombotic Drugs and Neuraxial Anesthesia/Analgesia or Peripheral Nerve Blocks** • For all patients undergoing neuraxial anesthesia or analgesia, the guideline developers recommend appropriate patient selection and caution when using anticoagulant thromboprophylaxis **(Grade 1A)**. • For patients receiving deep peripheral nerve blocks, the guideline developers recommend that the same cautions considered for neuraxial techniques be applied when using anticoagulant thromboprophylaxis **(Grade 1C)**. **Orthopedic Surgery** **Other Thromboprophylaxis Issues in Major Orthopedic Surgery** *Screening for DVT Before Hospital Discharge* For asymptomatic patients following major orthopedic surgery, the guideline developers recommend against the routine use of Doppler ultrasonography (DUS) screening before hospital discharge **(Grade 1A)**.
BSC (2007)	No recommendations offered.
MECHANICAL AND PHARMACOLOGIC THROMBOPROPHYLAXIS Abbreviations Back to TOC	
AAOS (2007)	The following recommendations are based on a systematic review of the literature and are evidence-based. **Chemoprophylaxis of Patients Undergoing Hip or Knee Replacement** **Patients at standard risk of both PE and major bleeding** should be considered for one of the chemoprophylactic agents evaluated in this guideline, including in alphabetical order: a. Aspirin, 325 mg 2x/day (reduce to 81 mg 1x/day if gastrointestinal symptoms develop), starting the day of surgery, for 6 weeks. b. LMWH, dose per package insert, starting 12-24 hours post-operatively (or after an indwelling epidural catheter has been removed), for 7 to 12 days (N.B., the LMWHs have not been sufficiently evaluated for longer periods to allow recommendation beyond this period). c. Synthetic pentasaccharides, dose per package insert, starting 12 to 24 hours postoperatively (or after an indwelling epidural catheter has been removed), for 7 to 12 days (N.B., the synthetic pentasaccharides have not been sufficiently evaluated for longer periods to allow recommendation beyond this period).

d. Warfarin, with an INR goal of ≤2.0, starting either the night before or the night after surgery, for 2 to 6 weeks.

(**Level III, Grade B** [choice of prophylactic agent], **Grade C** [dosage and timing]).

Note: The grade of recommendation was reduced from B to C for dosage and timing because of the lack of consistent evidence in the literature defining a clearly superior regime.

Patients at elevated (above standard) risk of PE and at standard risk of major bleeding should be considered for one of the chemoprophylactic agents evaluated in this guideline, including in alphabetical order:

a. LMWH, dose per package insert, starting 12 to 24 hours post-operatively (or after an indwelling epidural catheter has been removed), for 7 to 12 days (N.B., the LMWHs have not been sufficiently evaluated for longer periods to allow recommendation beyond this period).
b. Synthetic pentasaccharides, dose per package insert, starting 12 to 24 hours postoperatively (or after an indwelling epidural catheter has been removed), for 7 to 12 days (N.B., the synthetic pentasaccharides have not been sufficiently evaluated for longer periods to allow recommendation beyond this period).
c. Warfarin, with an INR goal of ≤2.0, starting either the night before or the night after surgery, for 2 to 6 weeks.

(**Level III, Grade B** [choice of prophylactic agent], **Grade C** [dosage and timing]).

Note: The grade of recommendation was reduced from B to C for dosage and timing because of the lack of consistent evidence in the literature on risk stratification of patient populations.

Patients at standard risk of PE and at elevated (above standard) risk of major bleeding should be considered for one of the chemoprophylactic agents evaluated in this guideline, including in alphabetical order:

a. Aspirin, 325 mg 2x/day (reduce to 81 mg 1x/day if gastrointestinal symptoms develop), starting the day of surgery, for 6 weeks.
b. Warfarin, with an INR goal of ≤2.0, starting either the night before or the night after surgery, for 2 to 6 weeks.
c. None

(Level III, Grade C)

Note: The grade of recommendation was reduced from B to C for dosage and timing because of the lack of consistent evidence in the literature on risk stratification of patient populations.

Patients at elevated (above standard) risk of both PE and major

	bleeding should be considered for one of the chemoprophylactic agents evaluated in this guideline, including in alphabetical order: a. Aspirin, 325 mg 2x/day (reduce to 81 mg 1x/day if gastrointestinal symptoms develop), starting the day of surgery, for 6 weeks. b. Warfarin, with an INR goal of $\leq$2.0, starting either the night before or the night after surgery, for 2 to 6 weeks. c. None **(Level III, Grade C)** **Note**: The grade of recommendation was reduced from B to C for dosage and timing because of the lack of consistent evidence in the literature on risk stratification of patient populations. No studies currently include patients at elevated risk of major bleeding and/or PE in study groups.
ACCP (2008)	**<u>Orthopedic Surgery</u>** **Elective Hip Replacement** 1. For patients undergoing elective THR, the guideline developers recommend the routine use of one of the following anticoagulant options: (1) LMWH (at a usual high-risk dose, started 12 hours before surgery or 12 to 24 hours after surgery, or 4 to 6 hours after surgery at half the usual high-risk dose and then increasing to the usual high-risk dose the following day); (2) fondaparinux (2.5 mg started 6 to 24 hours after surgery); or (3) adjusted-dose VKA started preoperatively or the evening of the surgical day (INR target, 2.5; INR range, 2.0 to 3.0) **(all Grade 1A)**. 2. For patients undergoing THR, the guideline developers recommended against the use of any of the following: aspirin, dextran, LDUH, GCS, or VFP as the sole method of thromboprophylaxis **(all Grade 1A)**. 3. For patients undergoing THR who have a high risk of bleeding, the guideline developers recommend the optimal use of mechanical thromboprophylaxis with the VFP or IPC **(Grade 1A)**. When the high bleeding risk decreases, the guideline developers recommend that pharmacologic thromboprophylaxis be substituted for or added to the mechanical thromboprophylaxis **(Grade 1C)**. **Elective Knee Replacement** 1. For patients undergoing TKR, the guideline developers recommend routine thromboprophylaxis using LMWH (at the usual high-risk dose), fondaparinux, or adjusted-dose VKA INR target, 2.5; INR range, 2.0 to 3.0) **(all Grade 1A)**. 2. For patients undergoing TKR, the optimal use of IPC is an alternative option to anticoagulant thromboprophylaxis **(Grade 1B)**. 3. For patients undergoing TKR, the guideline developers recommend against the use of any of the following as the only method of thromboprophylaxis: aspirin **(Grade 1A)**, LDUH **(Grade 1A)**, or VFP **(Grade 1B)**. 4. For patients undergoing TKR who have a high risk of bleeding, the guideline

	developers recommend the optimal use of mechanical thromboprophylaxis with IPC **(Grade 1A)** or VFP **(Grade 1B)**. When the high bleeding risk decreases, the guideline developers recommend that pharmacologic thromboprophylaxis be substituted for or added to the mechanical thromboprophylaxis **(Grade 1C)**. **Other Thromboprophylaxis Issues in Major Orthopedic Surgery** *Commencement of Thromboprophylaxis* 1. For patients receiving LMWH as thromboprophylaxis in major orthopedic surgery, the guideline developers recommend starting either preoperatively or postoperatively **(Grade 1A)**. 2. For patients receiving fondaparinux as thromboprophylaxis in major orthopedic surgery, the guideline developers recommend starting either 6 to 8 hours after surgery or the next day **(Grade 1A)**. *Screening for DVT Before Hospital Discharge* For asymptomatic patients following major orthopedic surgery, the guideline developers recommend against the routine use of Doppler ultrasonography (DUS) screening before hospital discharge **(Grade 1A)**. *Duration of Thromboprophylaxis* 1. For patients undergoing THR, TKR, or hip fracture surgery, the guideline developers recommend thromboprophylaxis with one of the recommended options for at least 10 days **(Grade 1A)**. 2. For patients undergoing THR, the guideline developers recommend that thromboprophylaxis be extended beyond 10 days and up to 35 days after surgery **(Grade 1A)**. The recommended options for extended thromboprophylaxis in THR include LMWH **(Grade 1A)**, a VKA **(Grade 1B)**, or fondaparinux **(Grade 1C)**. 3. For patients undergoing TKR, the guideline developers suggest that thromboprophylaxis be extended beyond 10 days and up to 35 days after surgery **(Grade 2B)**. The recommended options for extended thromboprophylaxis in TKR include LMWH **(Grade 1C)**, a VKA **(Grade 1C)**, or fondaparinux **(Grade 1C)**.
BSC (2007)	**Recommendations for the Perioperative Prophylaxis of VTE** *Elective Hip Arthroplasty* • Enoxaparin 40 mg subcutaneously 12 hours before or 12 to 24 hours after surgery or 20 mg subcutaneously 4 to 6 hours after surgery; then 40 mg/day on the days following surgery; **Class I, Level of Evidence A**. • Warfarin: adjust dose to keep INR between 2 and 3; start administration before surgery or immediately after surgery; **Class I, Level of Evidence A**.

- Heparin subcutaneously at 8-hour intervals, loading dose of 3500 IU ± 500 IU per dose to keep arterial partial thromboplastin time (aPTT) above normal; **Class IIa, Level of Evidence A**.
- Prophylactic measures associated with IPC or compression stockings; **Class IIa, Level of Evidence C**.
- Prophylaxis should last at least 7 days. **Class I, Level of Evidence A**.

Elective Knee Arthroplasty

- Enoxaparin 40 mg subcutaneously 12 hours before or 12 to 24 hours after surgery, or 20 mg subcutaneously 4 to 6 hours after surgery, then 40 mg/day on the days following surgery; **Class I, Level of Evidence A**.
- Warfarin: adjust dose to keep INR between 2 and 3. Start before surgery or immediately after surgery; **Class I, Level of Evidence A**.
- IPC — start immediately before surgery until hospital discharge; **Class I, Level of Evidence B**.

Prophylaxis should last at least 7 to 10 days; **Class I, Level of Evidence A**.

STRENGTH OF EVIDENCE AND RECOMMENDATION GRADING SCHEMES **Abbreviations** **Back to TOC**	
AAOS (2007)	The quality of evidence was rated using an evidence hierarchy for each of four different study types: therapeutic, prognostic, diagnostic, and economic or decision modeling. These hierarchies are shown below. These hierarchies were predefined by the American Academy of Orthopaedic Surgeons (AAOS) and appear on the AAOS web site at http://www2.aaos.org/aaos/archives/bulletin/feb03/fline1.htm. **Level I** evidence is from high quality randomized clinical trials (e.g., a randomized trial comparing revision rates in patients treated with cemented and uncemented total hip arthroplasty). **Level II** evidence is from cohort studies (e.g., revision rates in patients treated with uncemented total hip arthroplasty compared with a control group of patients treated with cemented total hip arthroplasty at the same time and institution). **Level III** evidence is from case-control studies (e.g., the rates of cemented and uncemented total hip arthroplasty in patients with a particular outcome called "cases"; i.e. revised total hip arthroplasty, are compared to those who did not have outcome, called "controls"; i.e. non-revised total hip arthroplasty). **Level IV** evidence is from an uncontrolled case series (e.g., a case series of patients treated with uncemented total hip

arthroplasty).

Level V evidence is from expert opinion.

Recommendation Grades

A: Good evidence (Level I Studies with consistent finding) for recommending intervention.

B: Fair evidence (Level II or III Studies with consistent findings) for recommending intervention.

C: Poor quality evidence (Level IV or V) for recommending intervention.

ACCP (2008)

Grading Recommendation			
Grade of Recommendation*	**Benefit vs. Risk and Burdens**	**Methodologic Quality of Supporting Evidence**	**Implications**
Strong recommendation, high-quality evidence, Grade 1A	Desirable effects clearly outweigh undesirable effects, or *vice versa*	Consistent evidence from RCTs without important limitations or exceptionally strong evidence from observational studies	Recommendation can apply to most patients in most circumstances; further research is very unlikely to change our confidence in the estimate of effect
Strong recommendation, moderate-quality evidence, Grade 1B	Desirable effects clearly outweigh undesirable effects, or *vice versa*	Evidence from RCTs with important limitations (inconsistent results, methodologic flaws, indirect or imprecise), or very strong evidence from observational studies	Recommendation can apply to most patients in most circumstances; higher quality research may well have an important impact on our confidence in the estimate of effect and may change the estimate

Strong recommendation, low or very low-quality evidence, Grade 1C	Desirable effects clearly outweigh undesirable effects, or *vice versa*	Evidence for at least one critical outcome from observational studies, case series, or from RCTs with serious flaws or indirect evidence	Recommendation can apply to most patients in many circumstances; higher-quality research is likely to have an important impact on our confidence in the estimate of effect and may well change the estimate
Weak recommendation, high-quality evidence, Grade 2A	Desirable effects closely balanced with undesirable effects	Consistent evidence from RCTs without important limitations or exceptionally strong evidence from observational studies	The best action may differ depending on circumstances or patient or society values; further research is very unlikely to change our confidence in the estimate of effect
Weak recommendation, moderate-quality evidence, Grade 2B	Desirable effects closely balanced with undesirable effects	Evidence from RCTs with important limitations (inconsistent results, methodologic flaws, indirect or imprecise), or very strong evidence from observational studies	Best action may differ depending on circumstances or patient or society values; higher-quality research may well have an important impact on our confidence in the estimate of effect and may change the estimate
Weak recommendation, low or very low-quality evidence, Grade 2C	Desirable effects closely balanced with	Evidence for at least one critical outcome from observational	Other alternatives may be equally reasonable; higher-quality

	undesirable effects	studies, case series, or from RCTs with serious flaws or indirect evidence	research is likely to have an important impact on our confidence in the estimate of effect and may well change the estimate

*The guideline developers use the wording *recommend* for strong (Grade 1) recommendations and *suggest* for weak (Grade 2) recommendations.

BSC (2007)

Degree or Class of Recommendation

Class I: Conditions for which there is evidence for and/or general agreement that the procedure/therapy is useful and effective

Class II: Conditions for which there is conflicting evidence and/or a divergence of opinion about the usefulness/efficacy of performing the procedure/therapy

Class IIa: Weight of evidence/opinion is in favor of usefulness/efficacy

Class IIb: Usefulness/efficacy is less well established by evidence/opinion

Class III: Conditions for which there is evidence for and/or general agreement that the procedure/therapy is not useful/effective and in some cases may be harmful

COMPARISON OF METHODOLOGY
Click on the links below for details of guideline development methodology

AAOS (2007)	ACCP (2008)	BSC (2007)

With regard to methods used to collect and select the evidence, AAOS and ACCP performed searches of electronic databases and hand searches of published literature (primary sources). AAOS also performed hand searches of published secondary sources. AAOS and ACCP both specify the date range that was searched, 1970 to August 2006 and 2002 to May 2006, respectively. Both also provide search terms used and inclusion/exclusion

criteria that were applied. One difference between the search strategies employed by AAOS and ACCP is that AAOS considered only symptomatic PE as the endpoint, whereas ACCP also included venous thrombosis. This difference in search strategies and resulting evidence considered may have contributed to some of the differences in recommendations presented. BSC performed searches of electronic databases, but does not provide a description of the process.

To assess the quality and strength of the evidence, all three groups weighted it according to a rating scheme and provide the scheme. Methods used by AAOS and ACCP to analyze the evidence were the same, with both groups having performed a systematic review with evidence tables and a review of published meta-analyses. Both provide a description of the process. BSC performed a systematic review to analyze the evidence. They do not provide details.

With regard to formulation of recommendations, all groups used expert consensus. AAOS specifies the nominal group technique; ACCP a consensus development conference. All three groups graded the recommendations according to a rating scheme and provide the scheme.

AAOS and BSC did not perform a cost analysis nor review published cost analyses. ACCP, in contrast, implemented recommendations of a recent ACCP task force on integrating resource allocation in clinical practice guidelines by restricting resource expenditure consideration to a small number of recommendations for which they were particularly relevant. Refer to "Strategies for incorporating resource allocation and economic considerations" (see "Availability of Companion Documents" field of the guideline summary) for details of the cost analyses. All groups employed a variation of peer review to validate the guideline. AAOS and ACCP specify internal peer review; ACCP also used external peer review. AAOS and ACCP provide a description of the process; BSC does not provide details.

SOURCE(S) OF FUNDING
Abbreviations
Back to TOC

AAOS (2007)	American Academy of Orthopaedic Surgeons
ACCP (2008)	American College of Chest Physicians
BSC (2007)	Brazilian Society of Cardiology

BENEFITS AND HARMS Abbreviations Back to TOC	
Benefits	
AAOS (2007)	Appropriate risk assessment and thromboprophylactic therapy in patients undergoing hip or knee replacement therapy to prevent serious thromboembolic complications, bleeding-related risks, and medical adverse effects of total hip and knee replacement
ACCP (2008)	• A vast number of randomized clinical trials over the past 30 years provide irrefutable evidence that primary thromboprophylaxis reduces DVT and PE, and there are studies that have also shown that fatal PE is prevented by thromboprophylaxis. • Routine use of thromboprophylaxis reduces adverse patient outcomes while at the same time decreasing overall costs.
BSC (2007)	• Reduction of risk of perioperative complications and mortality • Prevention of perioperative complications • Prevention of perioperative mortality
Harms	
AAOS (2007)	Adverse events including major bleeding
ACCP (2008)	• For some patients, anticoagulant prophylaxis may increase the risk of bleeding. • The use of LDUH is associated with a small increased risk of the limb- and life-threatening complication, heparin-induced thrombocytopenia (HIT).
BSC (2007)	• Risk of hemorrhagic complications from anticoagulants and antiplatelet agents • Risk of thromboembolism from inadequate anticoagulation

CONTRAINDICATIONS Abbreviations Back to TOC	
AAOS (2007)	Not stated
ACCP (2008)	• Current contraindications to the early initiation of anticoagulant thromboprophylaxis include the presence of intracranial bleeding, ongoing and uncontrolled bleeding elsewhere, and incomplete spinal cord injury (SCI) associated with suspected or proven spinal hematoma. • For patients with a history of heparin-induced thrombocytopenia (HIT), thromboprophylaxis with heparin or a LMWH should generally be avoided.
BSC (2007)	Not stated

Abbreviations
Back to TOC

AAOS, American Academy of Orthopaedic Surgeons

ACCP, American College of Chest Physicians

BSC, Brazilian Society of Cardiology

DUS, Doppler ultrasonography

DVT, deep venous thrombosis

GCS, graded compression stockings

INR, international normalized ratio

IPC, intermittent pneumatic compression

LDUH, low-dose unfractionated heparin

PE, pulmonary embolism

SQ, subcutaneous

THR, total hip replacement

TKR, total knee replacement

VFP, venous foot pump

VKA, vitamin K antagonist

VTE, venous thromboembolism

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